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Book Reviews

People and Place, Information and Structure

Designs for Life: Molecular Biology after World War II
By Soraya de Chadarevian
Cambridge: Cambridge University Press (2002).
384 pp. $55.00

The breadth implied by de Chadarevian's title is a bit misleading. As she notes in the second chapter of the Introduction, she focuses on the establishment of the Medical Research Council's Laboratory of Molecular Biology (LMB) in Cambridge, England because, as she adds in the final chapter, "The Laboratory of Molecular Biology serves as a vantage point to study the making of molecular biology." De Chadarevian suggests that "...molecular biology is now expected to take the dominant role in the twenty-first century that physics played in the twentieth," and argues that molecular biology "…was produced as much in the laboratory as in the political and public arena." The principals of the field—Lawrence Bragg, Max Perutz, John Kendrew, and Francis Crick—were instrumental in both characterizing the term and distinguishing it from biophysics. The research of Perutz, Kendrew, and Crick; later associates, such as Fred Sanger, Hugh Huxley, and Sydney Brenner; and visitors, notably Jim Watson, fundamentally advanced the discipline. These scientists and many others were also involved in the politics and changes of administration that inevitably accompany a new discipline.

This book is not intended to be a history of molecular biology as are the classics of Olby (1974) and Judson (1979). Nor is it a narrow, archival study of the establishment and early history of the LMB itself. What it does do, quite successfully, is to synthesize two perspectives: how the research of Perutz et al. played a central role in the success of the fledgling discipline and establishment of the LMB, and how, in turn, the LMB facilitated the research of its denizens and influenced the infrastructure of science in the UK and more generally in Europe.

Her selection of key scientific discoveries is well balanced; however, one might quibble about the details. During the 1930s, it was generally assumed that the genetic material was protein. DNA was messy, derived from the pus of bandages or from sperm; it lacked both cachet and good physical characterization. The experiments of Avery, MacLeod, and McCarty in 1943 demonstrating that DNA encodes genetic information surely should have been mentioned in setting the stage. Watson certainly appreciated its significance. The publication of the model of the α helix by Pauling, Corey, and Branson in 1951 motivated Cochran, Crick, and Vand in 1952 to derive the formula for the diffraction of X-rays by a helix; this theoretical foundation was essential in Crick's demonstration that DNA is a double helix and in his calculation of its pitch and repeat. Also fundamental to the story was the realization by Chargaff that the molar ratios of adenine and thymine, and of guanine and cytosine, are equal for any given DNA. Research on DNA did not drive the development of the LMB, nor did the Watson and Crick paper of 1953 immediately assume the iconic status in molecular biology that history has assigned to it. However, this publication, with its coy "It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material," had a profound and immediate impact on those working in the field later to be called molecular biology as well as on the broader scientific public. It motivated the famous experiment of Meselson and Stahl in 1958, which demonstrated that replication of DNA is semiconservative. De Chadarevian might also have mentioned the contributions of Brenner and Crick in solving the genetic code, and highlighted the importance of Crick's 1966 "wobble" paper as one of the few really predictive models in molecular biology.

The significance of penicillin, radar, and the atomic bomb for the war effort certainly solidified public support for science both in Britian and in the US. Men more experienced and mature, such as Kendrew and Crick, brought back to the universities and research institutions after military service broader and more flexible views of science and its organization. Cambridge, too, was adapting to new circumstances and opportunities. Anyone familiar with academic politics recognizes the issues: Is *x* (protein crystallography or comics) really *y* (physics or literature)? Will creating a new department of molecular biology drain resources from biochemistry? Will these chaps carry a fair share of instruction and, if not, should they be paid from University coffers? Not surprising, no single answer is provided, but it is reassuring to see that others have struggled with these issues.

Perhaps the very factors that contributed to the success of the LMB provoked criticism of the institute in the 1980s. While leading British scientists populated the LMB, they did not then propagate new foci throughout the UK, in contradistinction to the many visiting postdoctoral fellows from the US. The culture of the LMB didn't encourage scientists such as Milstein and Köhler to apply for patents (on monoclonal antibodies) and to establish biotech companies. Fostering over a half dozen Nobel laureates just wasn't considered enough return.

Bench scientists are frequently critical of administrators, who are assumed to have lost touch and grown too comfortable with lavish receptions and higher salaries—so be it. The author puts Kendrew's contributions in perspective. He recognized that much of crystallography is computation and data manipulation and showed creative leadership in both exploring the potential of and applying the latest technologies (digital computers [from EDSAC to VAX 11/780] and densitometers) to the myoglobin and hemoglobin projects. His initiative in founding the *Journal of Molecular Biology* in 1959 and subsequently in establishing the European Molecular

Biology Laboratory in Heidelberg are well analyzed and appreciated.

It is gratifying to see that the essential contributions of Mike Fuller in managing the structure and flow of information through stores, of Leslie Barnett in running the phage project, and of Gisela Perutz in nurturing the canteen are acknowledged. This introduces a deeper issue, one exceedingly difficult to document or analyze: the culture of science. Obviously, one needs talented and committed scientists, which Cambridge possessed and attracted in abundance. Although science, not unlike creative art, is fundamentally an individual activity, the interactions of scientists can be either highly synergistic or negative. The academic politics of Cambridge remain Byzantine and the principals certainly had their idiosyncrasies; nonetheless, they honored high intellectual and professional standards. The LMB, once referred to simply as the MRC, was a wonderful place to work and brought out the best in people. To some extent this may reflect the chance statistics of small numbers and to some extent the personalities of Bragg, Perutz, Kendrew, Crick, and their successors. De Chadarevian certainly acknowledges the importance for research of this positive atmosphere, as well as the continuing support of the Medical Research Council. Future historians and sociologists of science might seek deeper analyses of this most important and elusive of topics.

Names matter. They affect public image, funding, and infrastructure. They affect scientists' self images and political interactions. De Chadarevian nicely summarizes the implications of biophysics, molecular biology, and molecular genetics for both the people doing science and for a spectrum of benefactors, including the Rockefeller Foundation and the Medical Research Council. After seventy years, biophysics as a discipline still has journals, societies, and funding and is still blessed, or plagued, as being a catch-all for any physical technique or concept applied to a biological question. To a great extent the contents of the *Journal of Molecular Biology* initially defined its namesake. As the author emphasizes, even by 1950 there were two distinct concepts and approaches: that of structural biology, as epitomized by the research on hemoglobin and the 1951 model of the α helix, and that of information, the extension of genetics from *Drosophila* and maize to bacteriophage as reflected by the studies of Delbrück and colleagues at Cal Tech and Cold Spring Harbor Laboratories. The LMB successfully realized the complementarity of these two approaches; although obviously desirable and successful in retrospect, not all labs in Europe or the US followed a similar model. Today, one still senses the tension between structural biology, molecular genetics, and more recently cell biology. If there be any moral to this story, it is the importance of extracting creative synergy from these tensions.

Robert H. Kretsinger
Department of Biology
University of Virginia
Charlottesville, Virginia 22903

DNA for the People?

The Double-Edged Helix: Social Implications of Genetics in a Diverse Society
Edited by J.S. Alper, C. Ard, A. Asch, P. Conrad, L.N. Geller, and J. Beckwith
Baltimore and London: The John Hopkins University Press (2002).
293 pp. $49.95.

In 1900 Mendel's work was rediscovered. Only a few years later experts believed that it was proven that human behavior is largely determined by genes. Mendelian inheritance was believed to be shown for schizophrenia, manic depression, and intelligence. The experts claimed that those with low intelligence had many more children than those with high intelligence. They proposed that this would lead to the cultural breakdown of the Western World. As responsible scientists, they tried to convince politicians that legal action was necessary to prohibit this coming disaster. They were successful. Thus immigrants were screened for intelligence in the United States. Laws were made in many states of the US, in the Scandinavian countries, and in Germany which allowed sterilization of the unfit, including against their will. In Germany, human geneticists and the Nazis formed a coalition. The Nazis supported the sterilization law and the geneticists supported the racist anti-Semitic measures. Thus, the German geneticists became involved in genocide. After 1945, all this broke down and human geneticists took much more cautious positions.

In 1953, the structure of DNA was discovered by Watson and Crick. Today a large part of the human genome has been sequenced and analyzed. Inheritance of human behavior is again a hot topic. And so are genetic diseases. The authors of the book ask the question what are the implications of genetics in a diverse society like the United States.

In the first chapter, Joseph S. Alper presents a competent view of the present genetics of human disease and behavior. Only a very few diseases are due to mutations in a single gene, most are multigenic. In particular, almost all behavioral traits are multigenic. Then Jon Beckwith writes about genetics in society and society in genetics. He recalls that traditionally human geneticists like Thomas Morgan have been reluctant to discuss questionable human genetics, i.e., eugenics, in public. Beckwith is the only author of this book who looks outside the US. He points out that genetic determinism is much less popular in France than it is in the States. Here he quotes, a real cosmopolitan, articles which appeared in French in Le Monde and in L'Humanité.

How is genetics presented in the news? Peter Conrad shows that the isolation of a gene is often announced on page 1. However the disappearance of a postulated gene, for example, of the Amish manic depression gene, or of the gay gene is only briefly noted, if at all. The growth and action of advocacy groups of the genetically afflicted is described in the chapter of Alan Stockdale and Sharon Terry, and in the chapter of Diane Beeson and Troy Duster. The Cystic Fibrosis (CF) and Sickle Cell Disease (SCD) people differ in their reactions to